

CESTODES FROM INDIAN BIRDS WITH A NOTE ON *LIGULA INTESTINALIS*

BY

T. SOUTHWELL, M.Sc., A.R.C.Sc., F.Z.S.

(Received for publication 25 September, 1922)

A few species of cestodes dealt with below were presented to the author by Lt.-Col. Clayton Lane, I.M.S. The rest of the collection (except *Ligula*) were obtained from animals which died in the Zoological Gardens, Calcutta, on which post mortems were made in the Indian Museum.

The following species are recorded in this paper :—

| PARASITE | HOST |
|--|--------------------------------|
| <i>Tetrabothrius erostris</i> | <i>Sterna bergii</i> |
| <i>Davainea tetragona</i> | <i>Pavo muticus</i> |
| " " | <i>Pavo cristatus</i> |
| " " | <i>Francolinus vulgaris</i> |
| <i>Davainea</i> (? <i>tetragona</i>) | <i>Pavo nigropennis</i> |
| <i>Davainea microscolecina</i> | <i>Eclectus vioratus</i> |
| " " | <i>Eos ricinata</i> |
| <i>Davainea polychalix</i> | <i>Lorius garrulus</i> |
| <i>Davainea cruciata</i> | <i>Pica rustica</i> |
| <i>Davainea</i> sp. | Crow pheasant |
| <i>Davainea urogalli</i> | Tragopan pheasant |
| <i>Davainea tragopani</i> , n.sp. | Tragopan pheasant |
| <i>Davainea centropi</i> , n.sp. | <i>Centropus rufipennis</i> |
| <i>Cotugnia fastigata</i> | <i>Ptistis coccineopterus</i> |
| <i>Dilepis cypselina</i> | <i>Dendrocitta leucogaster</i> |
| <i>Dilepis campylancristrota</i> | <i>Herodias garzetta</i> |
| " " | <i>Ardeola grayi</i> |
| <i>Choanotaenia decacantha</i> | Gallinago sp. |
| <i>Choanotaenia</i> (? <i>octocantha</i>) | Snipe |
| <i>Choanotaenia microsoma</i> , n.sp. | <i>Ploceus atrigula</i> |
| " " | <i>Melophus melanicterus</i> |
| <i>Cyclorchida omalancristrota</i> | <i>Platalea</i> sp. |
| <i>Rhabdometra tomica</i> | <i>Francolinus pictus</i> |
| <i>Hymenolepis medici</i> | <i>Pelicanus philippensis</i> |
| " <i>fuscus</i> | <i>Larus brunnicephalus</i> |
| " " | <i>Hydropogone caspia</i> |
| " <i>lanceolata</i> | <i>Chenopsis atrata</i> |

| PARASITE | HOST |
|----------------------------------|-----------------------------------|
| <i>Hymenolepis lanceolata</i> | <i>Cygnus atratus</i> |
| " " | Black swan |
| " <i>naja</i> " | <i>Copschychus saularis</i> |
| " " | <i>Sitta chinensis</i> |
| " <i>zosteropsis</i> | <i>Criniger flaveolus</i> |
| " " | <i>Melophus melanicterus</i> |
| " " | <i>Closa (?) chinensis</i> |
| " " | <i>Ploceus atrigula</i> |
| " " | <i>Dendrocitta</i> sp. |
| <i>Hymenolepis farcinalis</i> | <i>Pica rustica</i> |
| " <i>stylosa</i> | <i>Brachypternus aurantius</i> |
| " " | <i>Trochalopterum meridionale</i> |
| " " | <i>Pica rustica</i> |
| " <i>asymetrica</i> | <i>Urocissa occipitalis</i> |
| " (? <i>microcephala</i>) | <i>Ciconia alba</i> |
| " (? <i>simplex</i>) | <i>Tadorna cornuta</i> |
| " sp. | <i>Emberiza luteola</i> |
| " " | <i>Garrulax belangeri</i> |
| " " | <i>Oriolus melanocephalus</i> |
| " " | <i>Liothrix lutia</i> |
| " " | <i>Dendrocitta rufa</i> |
| " " | <i>Tadorna cornuta</i> |
| " <i>annandalei</i> n.sp. | <i>Limosa belgicæ</i> |
| <i>Echinocotyle uralensis</i> | Snipe |
| " " | <i>Gallinago</i> sp. |
| <i>Hymenolepis capillaroides</i> | Snipe |
| <i>Diploposthe laevis</i> | <i>Netta rufina</i> |
| " " | <i>Nyroca ferina</i> |
| " sp. (? <i>laevis</i>) | <i>Strepsilas interpres</i> |
| <i>Dioicocestus novæ guinææ</i> | <i>Podiceps albipennis</i> |
| <i>Cestode</i> sp. | <i>Sterna fluviatilis</i> |
| <i>Ligula intestinalis</i> | <i>Danio acquirinnatus</i> |

Family TETRABOTHRIIDAE, Ransom, 1909

Tetrabothrius erostris (Loennberg, 1889), Führmann, 1899

Three specimens without heads from intestine of *Sterna bergii*. Lake Tamblegam, Ceylon, 6.9.12. Numbered Z.E.V. $\frac{6047}{7}$ in the collection of the Indian Museum.

Family DAVAINIIDAE, Führmann, 1907

Sub-family DAVAININAE, Braun, 1900

Davainca tetragona (Molin, 1858), R. Blanchard, 1891

1. About fifty large specimens from intestine of *Pavo muticus*. Zoological Gardens, Calcutta. Collected by the author, 10.12.14.

2. About forty specimens, same host and locality. Collected by the author, 3.1.17.

3. About ninety specimens, same host and locality. Collected by the author, 4.4.18.

4. About twenty specimens, same host and locality. Collected by the author, 12.7.18.

5. Several large and complete specimens from *Pavo cristatus* (common pea-fowl). Zoological Gardens, Calcutta. Collected by the author, 17.4.18.

6. Two specimens without heads from intestine of black shouldered pea-fowl. Zoological Gardens, Calcutta. No date.

7. Several specimens from intestine of *Francolinus vulgaris* (black Francolin). Zoological Gardens, Calcutta. Collected by the author, 30.12.13.

Twelve entire specimens were mounted, and a number of detached heads. In many heads all the hooks had been lost. In others only the hooks on the suckers were missing; in still others some of the rostellar and sucker hooks were missing. Only in two or three heads were the hooks complete. In no case were the pores irregular, being invariably unilateral. Most of the strobilae were old and full of ripe eggs, but quite a number were ripe but not gravid. These measured from 5 mm. to 3 cms. in length.

Davainea (? *tetragona*)

A few fragments without head from intestine of *Pavo nigropennis* (black shouldered peacock). Collected by Lt.-Col. Clayton Lane, I.M.S., Berhampur, Bengal, 15.5.12.

Davainea microsolecina, Führmann, 1908

1. Five specimens from intestine of *Eclectus vioratus* (parrot). Zoological Gardens, Calcutta. Collected by the author, 22.1.14. Previously recorded from *Eclectus rosatus*.

2. Two specimens from intestine of *Eos ricinata*. Zoological Gardens, Calcutta. Collected by the author, 6.7.15.

Some of these specimens shewed a number of ripe segments strongly impregnated with lime. As a result they would not clear in clove oil, but after decalcifying in acid alcohol for several days they cleared readily. This phenomenon was often noted whilst working out the collection of Indian *Cestoda*.

Davainea polychalix, Kotlán, 1920

1. Four specimens from intestine of *Lorius garrulus*. Zoological Gardens, Calcutta. Collected by the author, 15.3.17.
2. Two specimens, same host and locality. Collected by the author, 13.3.17.

Davainea cruciata (Rud. 1819), Führmann, 1908

One specimen from intestine of *Pica rustica* (magpie). Zoological Gardens, Calcutta. No date.

Davainea sp.

A few fragments without heads from intestine of a crow pheasant. Zoological Gardens, Calcutta. Collected by the author, 22.4.15.

Davainea urogalli (Modeer, 1790), R. Blanchard, 1891

One specimen and several fragments from intestine of a Tragopan pheasant. Zoological Gardens, Calcutta. Collected by the author, 27.2.15.

In these specimens the head was about 380μ broad; its length could not be accurately determined because it passed into the neck, but it appeared to be at least 500μ . The suckers have a diameter of about 150μ and are armed with about 17 rows of hooks. The rostellum has a diameter of about 50μ , and is armed with a double row, each hook measuring 7 or 8μ . About 50 were counted, but a number of hooks had clearly been lost. The total number is probably less than 100.

The muscular system is feebly developed and consists of a few scattered longitudinal fibres, internal to which there occur a few transverse strands.

The ventral excretory vessels on each side are very large, having a diameter of about 120μ . They communicate with each other transversely by an equally large tube, in the posterior part of each segment. The dorsal vessel on each side is minute and has a diameter of 10μ only.

The parenchyma throughout the worm is greatly developed, and it is very spongy owing to the occurrence of numerous small excretory cavities.

The pores are unilateral and are situated in the anterior half of the segment. The testes number about 36-40; nine or ten are situated on the pore side and the rest posterior to the ovary, and aporal. Each testis has a diameter of about 55μ when mature. In full development they

extend from the dorsal to the ventral surfaces and from the anterior to the posterior margins. They lie strictly within the water vessels.

The cirrus pouch lies across the antero-lateral angle and extends to the water vessel.

The vagina is posterior to the cirrus pouch. Both the genital canals run between the dorsal and ventral excretory vessels.

Meggitt (1921) states that a number of eggs occur in each capsule, whilst Shipley (1909) states that the eggs lie singly in the parenchyma. In the Indian species the eggs at first occur in numbers in each capsule, but when fully developed each capsule contains only one onchosphere.

Führmann states that the eggs lie within the two ventral water vessels. In our specimens, sections shewed that a single discontinuous layer of eggs was closely adherent to the lateral wall of each vessel, but they did not extend beyond that limit.

DAVAINEA TRAGOPANI, n.sp.

Two specimens from intestine of a Tragopan pheasant. Zoological Gardens, Calcutta. Collected by the author, 27.2.15.

EXTERNAL ANATOMY

Only one of the specimens possessed a head. This worm measured 8.5 mm. in length, and its greatest breadth was 600μ . It was composed of 27 or 28 segments; the last segment measured 825μ in length and 600μ in breadth. The second specimen (without head) measured 7 mm. in length and its greatest breadth was 600μ . It contained 27 or 28 segments.

Head. This was 180μ broad and about 125μ long. Without destroying the head it was impossible to obtain accurate details relating to the hooks, but 23 hooks were counted in what appeared to be half the circumference of the rostellum. It seems, therefore, that the total number of hooks present was about 46. They did not appear to be in a double row. Their exact shape could not be made out, but they appeared to be typical. They measured 10μ in length. The suckers are armed, but all the hooks had been lost except in a portion of one sucker, where there appeared to be from 4 to 6 rows.

The neck measured about 300μ in length and was present in both specimens.

INTERNAL ANATOMY

Owing to lack of material the nervous, muscular, and excretory systems were not investigated.

Genitalia. Testes. There are 6 or 7 testes and they first appear in about Segment IV. When fully mature they measure about 70μ . Usually there are four situated aporally, one or two posterior to the ovary, and a single testis on the pore side, posterior to the internal extremity of the cirrus.

Vas deferens. The cirrus pouch when fully developed extends half-way across the segment; in 2 or 3 cases it extends a little more than half-way across. It has very thick (? muscular) walls. In Segment XVII it measures 250μ long and 110μ broad. The cirrus is peculiar in being

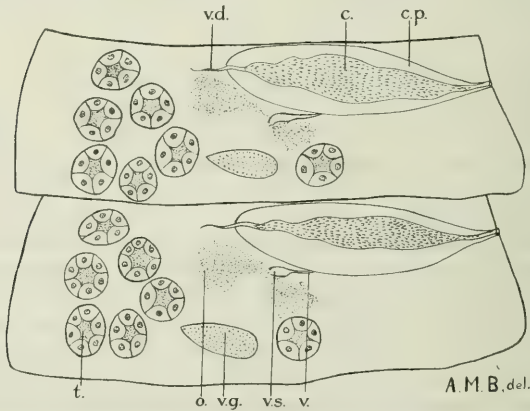


FIG. 1. *Davainea tragopani*, n.sp. Ripe segments, mounted whole, showing genitalia. c.—cirrus; c.p.—cirrus pouch; o.—ovary; t.—testes; v.—vagina; v.d.—vas deferens; v.g.—vitelline gland; v.s.—receptaculum seminis. $\times 210$.

a greatly dilated organ densely covered with minute spines, and almost filling the cirrus pouch. The cirrus pouch persists to the last segment. The vas deferens is short and very slightly coiled. No seminal vesicle was observed (fig. 1).

The genital pores are unilateral and are situated a little anterior to the middle point of the lateral margin of each segment.

Ovary. The ovary, which first appears in about Segment VIII, is definitely bilobed, each lobe being globular, and composed of a number of rounded acini. In full development each lobe measures about 70μ in diameter.

Receptaculum and vagina. From the pore the vagina pursues a direct course to a point between the two lobes of the ovary where it dilates into a receptaculum seminis.

Vitelline gland. This lies posterior to the ovary and is a conspicuous organ. In full development its transverse and anterior diameters measure about 60μ (fig. 1).

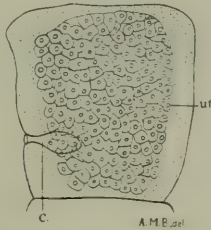


FIG. 2. *Davainea tragopani*, n.sp. Gravid segment, mounted whole, showing uterus. c.—cirrus pouch; ut.—uterus. $\times 50$.

Uterus. This first appears as a small cavity immediately anterior to, and between, the two lobes of the ovary. It enlarges and eventually single eggs become isolated in the parenchyma. In the last few segments no trace of the excretory vessels could be seen in either specimen; it is, therefore, impossible to say definitely whether the eggs extend beyond them or not. But as there was a definite area between the edge of the segment and the eggs, it would appear that the latter lie internal to the excretory vessel (fig. 2).

Eggs. These have a diameter of about 54μ and the onchosphere of about 25μ .

DIAGNOSIS

The species is related to the *proglottina* type. The following table gives details of the various species described which resemble *D. proglottina* in being of small size, and at the same time serves to shew the points in which *D. tragopani* differs from related species. I have, unfortunately,

been unable to procure Kowalewsky's paper. Führmann recently (1919) discussed the relationship of the first four species indicated in the table, and it would appear almost certain that *D. varians*, *D. dubius* and *D. proglottina* var. *dublanensis* are synonyms of *D. proglottina*.

The principal points in which *D. tragopani*, n.sp., differs from them all are:—(1) size; (2) number of segments; and (3) the unilateral pores.

The type specimen has been returned to the Indian Museum, Calcutta.

TABLE I.

| | Length | Breadth | No. of Segments | No. of Hooks | Size of Hooks | Suckers | Pores | Testes | Eggs |
|---------------------------------|---------|---------|-----------------|----------------|---------------|--------------------------|-----------------------|----------------|--------------------------|
| <i>D. proglottina</i> ... | mm. 1'5 | mm. 0'5 | 2-5 | 80-95 | 6 μ | 1 row armed | regularly alternate | 22 on one side | 35-40 μ |
| <i>D. varians</i> ... | 1'8 | ? | 4-6 | 44-50 | ? | 4-5 rows armed | regularly alternate | more than 10 | ? |
| <i>D. dubius</i> ... | 3'3 | 0'63 | 7-9 | 2 rows 50-60 | 7'1-8'4 μ | 4-6 rows armed | alternate | 12-15 | 33 μ oncho. 23 μ |
| <i>D. dublanensis</i> ... | 4'0 | ? | 6 | ... | ? | armed? | irregularly alternate | ? | ? |
| <i>D. tetraoensis</i> ... | 2'3 | 0'35 | 9-10 | 2 rows 120-130 | 9 μ | armed with several rings | a-ternate | about 30 | oncho. 27 μ |
| <i>D. minuta</i> ... | 1'0 | 0'4 | 8 | ? | 9 μ | unarmed | alternate | 10-12 | ? |
| <i>D. paucisegmentata</i> ... | 5'0 | 0'7 | 5 | ? | ? | unarmed | unilateral | 40 | 16 μ |
| <i>D. bimantopodis</i> ... | 1'0 | ? | 7-8 | 2 rows 50 | 7 μ | armed, no neck | irregularly alternate | 4 | 23 μ |
| <i>D. tragopani</i> , n.sp. ... | 8'0 | 0'6 | 27 | 2 rows 46 | 10 μ | 4 rows, armed | unilateral | 6 | 54 μ oncho. 25 μ |

DAVAINEA CENTROPI, n.sp.

Three specimens and two fragments from intestine of *Centropus rufipennis* (the common Caccal), Lake Tamblegam, Ceylon, October 1911. Numbered Z.E.V. $\frac{6103}{7}$ in the collection of the Indian Museum.

EXTERNAL ANATOMY

The specimens measured from 2.5 cms. to 3.5 cms. in length and had a maximum breadth of about 1.5 mm.

Head. The head is prominent and presents a truncated appearance ; it measured about 300μ broad. Its length could not be determined owing to the fact that it merges into a very short neck. The suckers have a diameter of about 300μ ; each sucker bears on its margin about 15 rows of hooks each measuring about 8μ . The rostellum is relatively small and is armed with about 300 hooks measuring from 9μ to 11μ in length and arranged in a double row.

Segments. The segments are very much broader than long, all except a few at the posterior extremity being quite shallow. Their lateral posterior margins are produced as shown in fig. 3. The genital pores are irregularly alternate being situated, and directed, anteriorly.

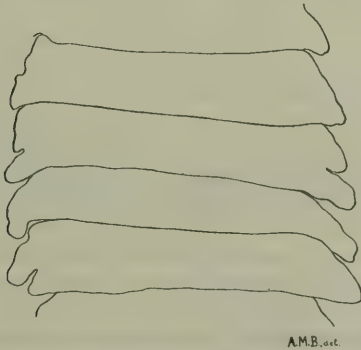


FIG. 3. *Davainea centropi*, n.sp. Outline of four segments. $\times 35$.

INTERNAL ANATOMY

Muscular system. This system is poorly developed ; the longitudinal fibres are relatively scanty and consist of small bundles somewhat widely separated ; the bundles decrease in size externally. The transverse fibres lie internal to the longitudinal muscles and are also very scanty. No oblique or dorso-ventral fibres were seen (fig. 4).

Nervous system. A small single nerve strand was to be seen lateral to the ventral water vessel on each side. On the pore side the nerve was ventral to the cirrus pouch and vagina.

Excretory system. This consists of a single ventral vessel on each side; on the pore side it lies ventral to the cirrus pouch (fig. 4).

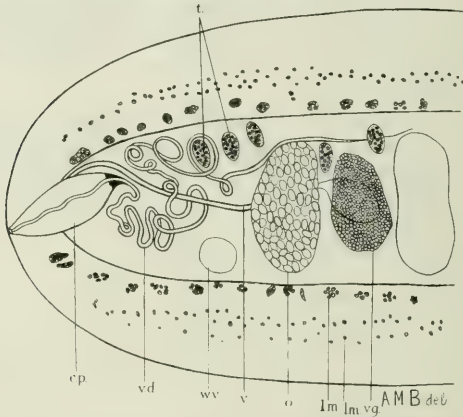


FIG. 4. *Davainea centropi*, n.sp. Transverse section showing cirrus pouch, vas deferens, vagina, ovary and muscular system. *c.p.*—cirrus pouch; *l.m.*—longitudinal muscle; *o.*—ovary; *t.*—testes; *v.*—vagina; *v.d.*—vas deferens; *v.g.*—vitelline gland; *w.v.*—water vessel. $\times 130$.

Genitalia. Testes. The testes are about forty in number; they lie dorsal and anterior on each side of the ovary and extend beyond the ventral excretory vessel. They are somewhat oval in shape and, when fully developed, measure about 85μ by 55μ .

Vas deferens. The vas deferens is remarkable in being very long. It extends half-way across the segment and is thrown into a large number of loops which occupy almost the entire field between the internal extremity of the cirrus pouch and the poral wing of the ovary. No seminal vesicle was observed. The cirrus pouch varies in length, extending from about half to three-quarters the distance between the lateral margin and the ventral excretory vessel (fig. 4).

Ovary. The ovary is a relatively large bi-lobed organ lying ventral

and posterior; in full development it extends almost to the dorsal transverse muscle fibres (figs. 4 and 5).

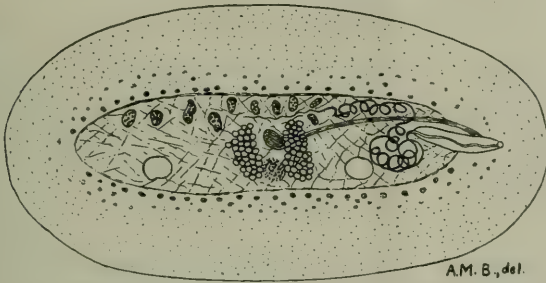


FIG. 5. *Davainea centropi*, n.sp. Transverse section showing male and female genitalia. $\times 70$.

Receptaculum and vagina. From the pore, the vagina runs dorsal to the cirrus pouch; at the internal extremity of the latter organ, the vagina curves gradually and runs directly to the ovary. It is muscular throughout its length. Its internal extremity is dilated into a muscular receptaculum seminis, which, in full development, measures about 150μ in length and 50μ in breadth (fig. 4). The oviduct, vitelline duct, and fertilisation canal are noticeable on account of their length.

Vitelline gland. This lies ventral to and between the two lobes of the ovary; it is large and easily seen (figs. 4 and 5).

Uterus. In full development, the uterus extends beyond the ventral excretory vessels and consists of a large number of parenchymatous capsules, each containing a single onchosphere.

Eggs. These have a diameter of about 55μ ; the onchosphere measures about 36μ .

DIAGNOSIS

Up to the present only about fourteen species of *Davainea* have been recorded which have armed suckers, and irregularly alternating genital pores. The species just described differs very definitely from them all. I therefore consider the species new and have named it *D. centropi*.

Cotugnia fastigata, Meggitt, 1920

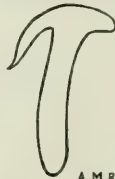
Three specimens from intestine of *Ptistes coccineopterus*, Gould, 1865. Zoological Gardens, Calcutta. Collected by the author, 13.11.15.

The specimens had the following measurements :—

TABLE II.

| | 1 | 2 | 3 |
|---------------------------|----------|----------|----------|
| Length | 75·0 mm. | 70·0 mm. | 60·0 mm. |
| Greatest breadth | 3·5 mm. | 3·8 mm. | 3·3 mm. |
| Number of segments | 212 | 210 | 205 |

As Meggitt was unable to isolate and figure a complete rostellar hook, a drawing of a hook from the Indian example is given below (fig. 6).



A. M. B. del.

FIG. 6. *Cotugnia fastigata*, Meggitt. Diagram of a hook.

In our specimens the vagina was almost invariably situated some distance posterior to the cirrus pouch, and as a result it was impossible to determine whether the vagina was dorsal or ventral to the pouch. In 6 or 7 segments examined, however, the vagina was definitely dorsal to the pouch on one side and ventral on the other—a character peculiar to the genus *Moniezia*.

Family *HYMENOLEPIDIDAE*, Railliet and Henry, 1909

Sub-family *DIPYLIDIINÆ*, Stiles, 1896

Dilepis cypselina, Neslobinsky, 1911

One fragment with a head, of what is almost certainly this species, was obtained from the intestine of *Dendrocitta leucogaster* (tree-pie); Zoological Gardens, Calcutta. Collected by the author, 7.12.15.

The head was armed with a double crown of about 90 hooks, measuring about 24μ . The genital pores were unilateral. The cirrus pouch was situated anteriorly, and extended almost to the water vessel.

Dilepis campylancristota (Wedl, 1855), Führmann, 1908

1. Four specimens from intestine of *Herodias garzetta* (paddy bird), Berhampore, Bengal. Collected by Lt.-Col. Clayton Lane, I.M.S., June, 1912. Numbered Z.E.V. $\frac{6019}{7}$ in the collection of the Indian Museum.

2. Numerous specimens from *Ardeola grayi* (pond heron), Zoological Gardens, Calcutta. Collected by the author, 14.12.13, and numbered Z.E.V. $\frac{6161}{7}$ in the collection of the Indian Museum.

Choanotaenia decacantha, Führmann, 1913

Four specimens from intestine of a snipe (*Gallinago* sp.), Berhampur, Bengal. Collected by Lt.-Col. Clayton Lane, I.M.S., 17.12.12.

The specimens agreed with Führmann's description except in the following minor details :—

(1.) The hooks measured 23.4μ ; in the type specimen they measured 19.8μ to 21.6μ .

(2.) The type specimen had from 40 to 50 segments; the Indian forms have from 40 to 98 segments.

Choanotaenia (? *octocantha*, Führmann)

1. One specimen, without head, from intestine of a snipe, Berhampur, Bengal. Collected by Lt.-Col. Clayton Lane, I.M.S., 12.3.12.

2. One specimen from same host and locality. Collected by Lt.-Col. Clayton Lane, I.M.S. (219 b), 17.12.12.

CHOANOTAENIA MICROSOMA, n.sp.

1. Six specimens from intestine of *Ploceus atrigula* (the eastern baya). Zoological Gardens, Calcutta. Collected by the author, 26.10.15.

2. About twelve specimens from intestine of *Melophus melanicterus* (the crested bunting). Zoological Gardens, Calcutta. Collected by the author, 25.6.15

EXTERNAL ANATOMY

The worms measure from 4 mm. to 8 mm. in length and have a maximum breadth of about 630μ . They consist of from 25 to about 50 segments.

Head. The head is square and measures about 220μ ; the suckers have a diameter of about 140μ . The rostellum measures about 180μ in length and has a diameter of about 50μ . Its anterior extremity is expanded and has a breadth of about 90μ and a length of 40μ . It is armed with a single row of from 16 to 20 hooks which measure about 35μ (fig. 7).

There is no neck.

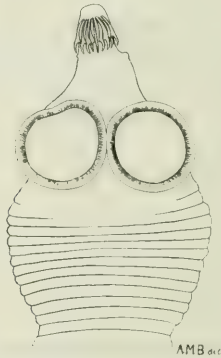


FIG. 7. *Cbounotaenia microsoma*, n.sp. Head and anterior segments. $\times 170$.

INTERNAL ANATOMY

Muscular, excretory and nervous systems. As the material was not sufficiently well preserved details of these systems are not obtainable.

Genitalia. Testes. There are from 16 to 20 testes situated posterior to the ovary. When fully mature they have a diameter of about 36μ (fig. 8).

Vas deferens. The genital pore is situated at the extreme anterior lateral angle of the segment and is very large and prominent. The cirrus pouch is short and narrow, extending to the water vessel to which it is dorsal. It lies anterior to the vagina. The cirrus is remarkable in

having its extreme tip armed with short spines set at right angles to its length. Immediately median to the tip, the cirrus is armed with a number of hooks of a different shape which measure 30μ in length, and which lie

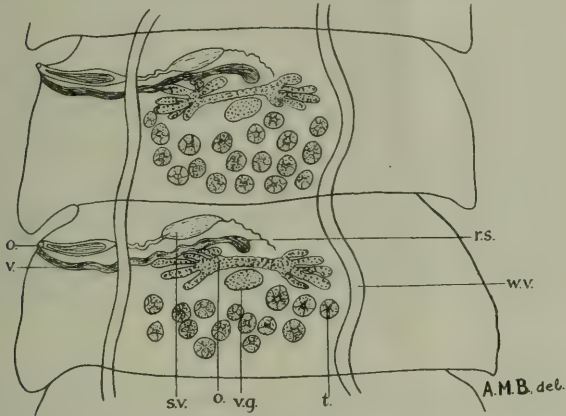


FIG. 8. *Cboanotaenia microsoma*, n.sp. Horizontal section showing male and female genitalia. o.—ovary; r.s.—receptaculum seminis; s.v.—seminal vesicle; t.—testes; v.g.—vitelline gland; w.v.—water vessel. $\times 230$.

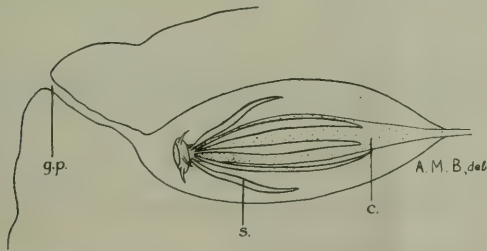


FIG. 9. *Cboanotaenia microsoma*, n.sp. Showing spines on cirrus. c.—cirrus; g.p.—genital pore; s.—spine. $\times 750$.

parallel to the cirrus (fig 9). The vas deferens dilates close to the median extremity of the cirrus pouch into a small seminal vesicle, and then continues in the median direction as a very fine tube (fig. 8).

Ovary. This organ lies quite anterior and is divided into two sets of acini, one on each side, widely separated from each other (fig. 8).

Receptaculum and vagina. The vagina is a wide muscular tube running posterior to the cirrus pouch and dorsal to the excretory vessel. Near the centre of the segment it dilates into a globular receptaculum, having a diameter of about 36μ (fig. 8).

Vitelline gland. This is a compact, deeply-staining organ lying posterior to a line joining the two wings of the ovary. It has a breadth of about 110μ (fig. 8).

Shell gland. This lies immediately anterior to the vitelline gland. It is somewhat globular and has a diameter of about 30μ .

Uterus. The uterus appears suddenly as a transverse sac situated in front of the ovary. In the next segment the ovary and testes have entirely and as suddenly disappeared, the whole segment being occupied by the uterus which extends beyond the water vessels. The eggs lie in capsules, one in each capsule.

DIAGNOSIS

The characters which distinguish this worm from other species of the genus *Choanotaenia* are: (1) its small size; (2) the small number of segments; (3) the number, size and shape of the hooks; (4) the peculiarly armed cirrus.

On account of its small size I have named it *Choanotaenia microsoma*.

Cyclorchida omalancristota (Wedl, 1856), Führmann, 1907

Several specimens from intestine of *Platalea* sp. (spoon bill). Zoological Gardens, Calcutta. Collected by the author, 21.11.13.

Sub-family *PARUTERININAE*, Ransom, 1909

Rhabdometra tomica, Cholodovsky, 1906

Two specimens from intestine of *Francolinus pictus* (painted partridge). Zoological Gardens, Calcutta. Collected by the author, 26.3.14.

The number of testes and the arrangement of the transverse and longitudinal muscle fibres left no doubt as to the identification of this species.

Sub-family *HYMENOLEPIDINAE*. Ransom, 1909

Hymenolepis medici (Stoss., 1890), Führmann, 1906

Several specimens from intestine of *Pelicanus philippensis*. Zoological Gardens, Calcutta, 18.9.19.

Hymenolepis fusus (Krabbe, 1869), Führmann, 1906.

1. A large number of specimens from *Larus brunneiceps*. Zoological Gardens, Calcutta. Collected by the author, 22.1.17.

The hooks varied in size from 12μ to 18μ . It is important to note that of five worms examined, all of them shewed three or four segments with only two testes.

2. A large number of specimens from *Hydropogon caspia* (tern). Zoological Gardens, Calcutta. Collected by the author, 17.2.15.

In six of these specimens it was found that the number of testes was not constant, many segments possessing only two.

Hymenolepis lanceolata (Bloch, 1782), (Weinland, 1858), Braun, 1903

1. Six small specimens 1 cm. long, without heads, from the Black Australian Swan, *Chenopsis atrata*, Berhampur, Bengal, numbered Z.E.V. $\frac{6050}{7}$ in the collection of the Indian Museum. Collected by Lt.-Col. Clayton Lane, I M S, 11.4.12.

2. About sixteen small specimens 2 to 3 cms. in length from same host. Zoological Gardens, Calcutta. Collected by the author, 24.4.18.

3. About twelve large specimens, 4 to 6 cms. in length and 1 cm. in breadth from same host. Zoological Gardens, Calcutta, 24.4.19.

4. About twenty large specimens, about 6 cms. in length and three small specimens, 2 cms. in length from *Cygnus atratus*. Zoological Gardens, Calcutta, 22.12.19.

5. Four large specimens, 4 to 6 cms. in length from the Black Swan. Zoological Gardens, Calcutta, 25.5.19. The variability of this species is discussed by Mapleston and Southwell in *Ann. Trop. Med. & Parasit.*, June, 1922.

Hymenolepis naja (Duj, 1845), Führmann, 1906

1. Three fragments from intestine of *Copschychus saularis* (Magpie robin). Zoological Gardens, Calcutta. Collected by the author, 5.8.15. All the fragments were stained and mounted.

2. Two specimens, one with a head, from *Sitta chinensis* (green

magpie). Zoological Gardens, Calcutta. Collected by the author, 27.4.15. Both specimens were stained and mounted.

Hymenolepis zosteropsis, Führmann, 1918

1. A large number of specimens from *Criniger flaveolus* (white cheeked Bulbul). Zoological Gardens, Calcutta. Collected by the author, 26.12.19. Our specimens measured from 2 mm. to 4 mm. in length; the hooks were very typical of the species.

2. About ten specimens from intestine of *Melophus melanicterus*. Zoological Gardens, Calcutta. Collected by the author, 25.6.15.

3. Four specimens from intestine of *Closa* (?) *chinensis* (green magpie). Zoological Gardens, Calcutta. Collected by the author, 28.4.15.

4. Five specimens from intestine of *Ploceus atrigula* (the eastern baya). Zoological Gardens, Calcutta. Collected by the author, 12.10.15.

5. Three specimens from intestine of *Melophus melanicterus* (the crested bunting). Zoological Gardens, Calcutta. Collected by the author, 25.6.15.

6. Six specimens from intestine of *Dendrocitta* sp. (tree-pie). Zoological Gardens, Calcutta. Collected by the author, 15.5.13., and numbered Z.E.V. $\frac{5953}{7}$ in the collection of the Indian Museum.

Hymenolepis farciminalis (Batsch, 1786) (R. Blanchard, 1891),
Führmann, 1906

Several specimens from intestine of *Pica rustica* (magpie). Zoological Gardens, Calcutta. Collected by the author, 10.7.18.

A striking feature of our specimens of this species was the fact that a single strobila contained segments with no testes, and segments with one, two, three or four testes, although most segments contained three. Another feature was that the testes in some segments were in line, in other segments there were two testes aporal and one poral, and vice versa. In fact their disposition was quite irregular.

Hymenolepis stylosa (Rud., 1810), Volz., 1899

1. Several specimens from intestine of *Brachypternus aurantius* (golden backed wood-pecker). Zoological Gardens, Calcutta. Collected by the author, 31.12.13.

2. Four specimens (only one with a head) from intestine of *Trochalopteron meridionale* (laughing thrush). Zoological Gardens, Calcutta. Collected by the author, 9.8.15.

3. Two young strobilae (2 cms. long) from intestine of *Pica rustica*. Zoological Gardens, Calcutta. Collected by the author, 10.7.18. These were mounted.

Hymenolepis capillaroides, Führmann, 1906

1. Three specimens (one with a head) from intestine of a snipe. Berhampur, Bengal. Collected by Lt.-Col. Clayton Lane, I.M.S., 21.7.12.

2. Two specimens, one with a head, same host and locality. Collected by Lt.-Col. Clayton Lane, I.M.S., 12.3.12.

Hymenolepis (? *asymetrica*), Führmann, 1918

Three badly preserved specimens, apparently of this species (only one with a head) from intestine of *Urocissa occipitalis* (red-billed blue magpie). Zoological Gardens, Calcutta. Collected by the author, 22.10.19

Führmann obtained the species from *Chalcococcyx plagosus*, New Guinea. His specimens measured 10 cms. in length and 1 mm. in breadth. The head was armed with 10 hooks 19 μ long, and of a peculiar shape. Our specimen was armed with exactly similar hooks of the same size. The Indian specimens measured 1 cm. only in length and were quite immature. In the posterior segments the testes were developing and the rudiments of the ovary could be seen.

Hymenolepis (? *microcephala*) (Rud, 1819), Führmann, 1906

Numerous specimens from intestine of *Ciconia alba* (white stork). Zoological Gardens, Calcutta. Collected by the author, 6.6.19.

Hymenolepis (? *simplex*)

1. Two fragments and one head from intestine of *Tadorna cornuta* (sheldrake). Zoological Gardens, Calcutta. Collected by the author, 26.3.15.

2. Numerous specimens without heads from same host and locality, 18.3.14.

Hymenolepis spp.

1. A few fragments of a small worm apparently about 12 mm. in length, from the intestine of *Emberiza luteola*. Zoological Gardens, Calcutta, 11.11.15. The fragments were in a bad state of preservation. No head was present ; there appeared to be three testes in the segments examined.

2. Other fragments also without heads from intestine of *Garrulax belangeri*. Zoological Gardens, Calcutta, 1.5.19.
3. Still others from intestine of *Oriolus melanocephalus*. Zoological Gardens, Calcutta, 12.10.15.
4. One specimen without head from intestine of *Liothrix lutia* (red-billed Liothrix). Zoological Gardens, Calcutta. Collected by the author, 29.5.16. The specimen measured 30 mm. in length and 2.5 mm in breadth. Two testes were situated on one side and one on the other.
5. Fragments from intestine of *Dendrocitta rufa*. Zoological Gardens, Calcutta, 13.6.15.
6. Several specimens without heads from intestine of *Tadorna cornuta* (common sheldrake). Zoological Gardens, Calcutta. Collected by the author, 18.3.14.
7. Two specimens without heads from same host and locality. Collected by the author, 23.6.15. In both specimens the testes were irregular, the conditions being similar to those described for *H. farciminalis*.

HYMENOLEPIS ANNANDALEI, n.sp.

Two specimens from the intestine of *Limosa belgicæ* (black-tailed godwit). Barkuda, Chilka Lake, Orissa, India. Collected by Dr. N. Annandale, 28.4.28.

EXTERNAL ANATOMY

The specimens had the following dimensions :—

| | Length | Greatest breadth |
|----|------------------------------|------------------|
| 1. | 60 mm. | 1.5 mm. |
| 2. | 103 mm. | 2 mm. |

The anterior part of the worm is attenuated and whip-like; all the segments are broader than long, the posterior and lateral margins being salient. The genital pores all unilateral, and situated slightly anterior to the middle of the lateral margin.

Head. The head measures about 180 μ in length and is 150 μ broad; the suckers have a diameter of about 80 μ . The rostellum is a conspicuous organ armed with a single row of 10 hooks which measure about 32 μ in length (fig. 10). Both in size and shape they closely resemble those of *H. brasiliense*, Führ.

The neck measures about 2 mm. in length.

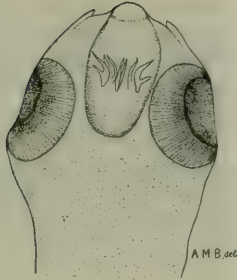


FIG. 10. *Hymenolepis annandalei*, n.sp. Showing head. $\times 220$.

INTERNAL ANATOMY

Muscular system. This is poorly developed. The longitudinal muscles consist of an inner and an outer series of bundles; the internal bundles are larger and fewer than the outer bundles, the latter being situated immediately beneath the cuticle. A few circular fibres occur between the outer and inner longitudinal bundles and also internal to the inner longitudinal fibres. No oblique fibres were seen (fig. 12).

Nervous system. Details of this system were not investigated. A small ill-defined nerve was observed in transverse sections, running external to the water vessel on each side.

Water vascular system. This consists of a single ventral vessel on each side, lying ventral to the cirrus pouch and vagina (fig. 12).

Genitalia. Testes. There were three testes; one is situated on the pore side and the other two are aporal, one being anterior to the other (figs. 11 and 12). When fully mature they have a diameter of about 150μ and occupy almost the whole of the segment dorso-ventrally.

Vas deferens. The cirrus pouch lies dorsal to the vagina; it is somewhat club-shaped, the broader extremity being median. It measures about 180μ in length and its greatest breadth is about 40μ . Its median half is occupied by an internal seminal vesicle. In the median direction it continues as a very short, wide, coiled tube and then dilates into a large external seminal vesicle which measures about 160μ in length and 30μ in breadth (fig. 12); the median extremity of the external seminal vesicle is close to the poral testis.

Ovary. The ovary is situated ventrally in the middle line, and posterior; it measures about 300μ broad and 100μ in the antero-posterior direction, whilst dorso-ventrally it practically fills the segment (fig. 11).

Receptaculum and vagina. The vagina is a very muscular organ measuring about 450μ in length and is club-shaped. At the pore its breadth is about 10μ ; it gradually widens and attains a maximum diameter of 50μ at a point opposite the middle of the external seminal vesicle. It then narrows gradually. The whole vagina functions as a receptaculum.

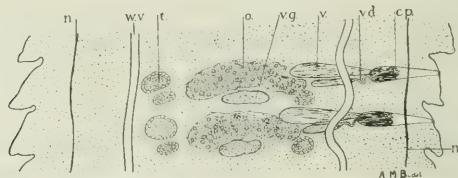


FIG. 11. *Hymenolepis annandalei*, n.sp. Horizontal section showing genitalia. *c.p.*—cirrus pouch; *n.*—nerve; *o.*—ovary; *t.*—testes; *v.*—vagina; *v.d.*—vas deferens; *v.g.*—vitelline gland; *w.v.*—water vessel. $\times 60$.

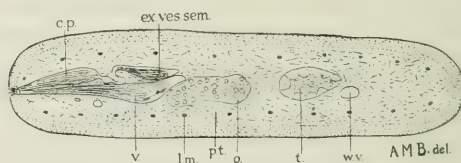


FIG. 12. *Hymenolepis annandalei*, n.sp. Transverse section showing cirrus pouch, vagina and the great development of parenchymatous tissue. *c.p.*—cirrus pouch; *ex.ves.sem.*—external vesicula seminalis; *l.m.*—longitudinal muscle; *o.*—ovary; *p.t.*—parenchymatous tissue; *t.*—testes; *v.*—vagina; *w.v.*—water vessel. $\times 72$.

Vitelline gland. This is a conspicuous bi-lobed organ situated posterior to the centre of the ovary. It is about 100μ broad (fig. 11).

Uterus. The uterus consists of a simple transverse sac extending well beyond the water vessel on each side, and almost to the edge of the segment. The eggs were not mature; the largest measured 17μ in diameter and the onchosphere measured 11μ (fig. 13).

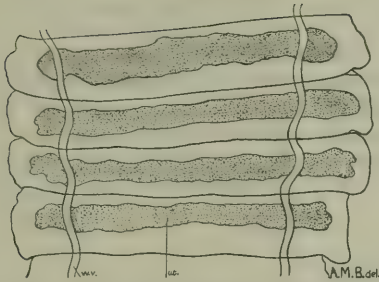


FIG. 13. *Hymenolepis annandalei*, n.sp. Whole segments showing fully developed uterus. ut.—uterus; w.v.—water vessel. $\times 35$.

DIAGNOSIS

The worm bears a very close resemblance to *H. brasiliense*, Führ. The only difference between them is that in Führmann's species the testes are in a line, whilst in *H. annandalei*, n.sp., this is not the case.

I have pleasure in naming this species in honour of Dr. Nelson Annandale, Director of the Zoological Survey of India.

Sub-genus *Echinocotyle*, Blanchard, 1891

Echinocotyle uralensis, Clerc, 1902

1. One specimen from intestine of snipe. Potsengbam, near Loktak Lake, Manipur, Assam (2600 feet), Station 1. Manipur Survey, 14.2.20.

This specimen agreed with Clerc's description, except that the hooks when isolated measured up to 74μ . In the type species they measure from 54μ to 66μ . In some segments testes were entirely absent; two other segments contained only one in each, and in four or five other segments the posterior aporal testis was absent.

2. One specimen from gut of a snipe. No further data given.

3. One specimen, without head, from *Gallinago* sp. (snipe). Berhampur, Bengal. Collected by Lt.-Col. Clayton Lane, 12.3.12.

4. Two specimens (one with a head) from intestine of a snipe. Berhampur, Bengal. Collected by Lt.-Col. Clayton Lane, (No. 219b), 17.12.12.

Family TAENIIDAE, Ludwig, 1886

Diploposthe laevis (Bloch, 1782), Jacobi, 1896

1. One complete specimen from intestine of *Netta rufina* (red-crested pochard). Zoological Gardens, Calcutta. Collected by the author, 29.I.14. The specimen was stained and mounted.

2. Fragments from intestine of *Nyroca ferina*, Chilka Lake, Orissa, India, 24.II.14. Numbered Z.E.V. $\frac{6874}{7}$ in the collection of the Indian Museum.

Diploposthe sp. (? *laevis*)

A fragment from intestine of *Strepsilas interpres* (turnstone plover). Chilka Lake, Orissa, 24.II.14. (Chilka Survey).

Family ACOLEIDAE, Ransom, 1909

Dioicocestus novae guineae, Führmann, 1914

1. Three specimens from intestine of *Podiceps albigennis* (the little grebe). Zoological Gardens, Calcutta. Collected by the author, 1.5.17.

They had the following measurements:—

TABLE III.

| Number | Length | Breadth | Thickness |
|------------------|-----------|---------|---------------|
| 1. Male | 10.0 cms. | 5.0 mm. | about 1.0 mm. |
| 2. Male | 10.0 cms. | 3.5 mm. | about 1.0 mm. |
| 3. Female | 17.0 cms. | 5.9 mm. | 1.6 mm. |

The head of the female worm (No. 3) is armed with at least 12 hooks, 320 μ long (fig. 14). Possibly a few hooks were missing. In shape these



FIG. 14. *Dioicocestus novae guineae*, Führmann. Showing hook. $\times 80$.

hooks are similar to those figured by Lühe for *D. aspera* (Mehlis), but in the latter species they measure only 200 μ to 218 μ , and are 14 in number. In the male specimens (Nos. 1 and 2) the hooks were missing, but the

impressions made in the parenchyma by these hooks were clearly visible. The only trace of genitalia in these two male strobilae consists of two cirrus pouches in each segment, each of which measures 750μ in length and 330μ in breadth. No spines were seen on the cirrus although carefully looked for. In the female strobila the ovary had almost entirely degenerated. There were a number of gravid segments; the eggs measured about 50μ and the onchosphere 28μ .

Four species of this genus are now known (Table IV).

TABLE IV.

| Species | Locality | Host | MALE | | FEMALE | | Rostellum | Suckers |
|--------------------|---------------------|---|-----------|-----------|-----------|-----------|---|----------------------|
| | | | Length | Breadth | Length | Breadth | | |
| <i>ronai</i> | ... Argentine | <i>Plegadis guarauna</i> | mm. 70 | mm. 40 | mm. 60 | mm. 50 | Practically absent | Practically absent |
| <i>otylus</i> | ... Jamaica, Brazil | <i>Podiceps dominicus</i> | 45-130 | 2-2.5 | 100-190 | 3.5-4.0 | Very small | Very small |
| <i>pera</i> | ... Europe | <i>Lopbaetbyia cristata</i> and <i>L. griseigena</i> | 280 | 6.0-9.0 | 340 | 8.0-11.5 | Well developed with 14 hooks. $200-218\mu$ in length | Well developed |
| <i>vae guineae</i> | New Guinea | <i>Podiceps novae hollandiae</i> | 60 | 3.5 | 50 | 4.5 | Moderately developed with 18-20 hooks | Moderately developed |

As the Indian specimens have well-developed suckers and a large rostellum, they are closely related to *D. aspera* and *D. novae guineae*. They differ from the former in size and in possessing larger hooks, and agree with Führmann's description of the latter genus. No hooks were present in Führmann's specimens.

2. A second very young female specimen of what I believe to be this species was obtained from the same host and locality, by Dr. Bains Prasad, 2.2.18. The specimen was strongly contracted and was ripe, but no gravid segments were present. It was sectioned and mounted.

Cestode sp.

A few fragments from *Sterna fluviatilis*. Zoological Gardens, Calcutta, 3.1.15.

Order PSEUDOPHYLLIDAE, Carus, 1863

Family DIPHYLLOBOTHRIDAE, Lühe, 1910

Genus *Ligula*, Bloch, 1782

Bothria as well as external segmentation completely absent from the larvae ; both develop simultaneously with the maturation of the sex-organs in the definitive host, where the external segmentation which does not correspond with the internal is confined to the anterior end. Longitudinal and transverse muscles irregularly interwoven in the anterior end, posteriorly separated into an inner transverse and an outer longitudinal layer.

Type (and only) species : *Ligula intestinalis* (L).

Ligula intestinalis (Linnaeus, 1758)

Three larval forms from the coelome of three specimens of *Danio acqipinnatus* (McClelland), collected by S. L. Hora, Esq., Indian Museum ; Pung-Ka-Mem-John stream, Cherrapunji, Khasi Hills, Assam, 28.10.21, and numbered W $\frac{423}{1}$ and W $\frac{424}{1}$ in the collection of the Indian Museum.

Lühe in 1898 arrived at the conclusion that there is only one species of *Ligula*, and this conclusion was accepted by Linstow in 1901 and by Cooper in 1918.

The synonymy of both the larval and adult forms is very extensive, and a complete list is given by Cooper (1918). The larval forms occur in the body cavity of Teleosts and the adults occur in the intestine of wading and diving birds.

Our specimens are typical in every respect and call for no comment.

The author has previously (1913) recorded the occurrence of this larva in the intestine of the following Indian fishes, viz., *Labeo calbasu* and *Nemachilus rupicola*.

Another larval form, viz., *Schistocephalus solidus*, occurs much less commonly in the abdominal cavity (and occasionally in the stomach and intestine) of bony fishes, but the larval form of this species is characterised by the fact that it is definitely segmented, and possesses two bothria, whereas in *Ligula intestinalis* bothria and all traces of external segmentation are absent.

REFERENCES

- BLANCHARD, R. (1891). Notices helminthologiques (2), in *Mém. Soc. Zool. France*, Vol. IV, p. 420. 38 fig.
- BLOCH, M. E. (1782). Abhandlung von der Erzeugung der Eingeweidewürmer und den Mitteln wider dieselben. 54 pp., 10 pls. Berlin.
- CHOLODKOVSKY, N. (1905). Cestodes nouveaux ou peu connus, I. *Arch. Parasitol.*, Vol. X, pp. 332-345. 3 plates.
- CLERC, W. (1902). Contribution à l'étude de la faune helminthologique de l'Oural, I, II. *Zool. Anz.*, Vol. XXV, pp. 569-575, 658-664. 10 fig.
- (1903). Contribution à l'étude de la faune helminthologique de l'Oural. *Rev. Suisse Zool.*, Vol. II, pp. 241-386, tab. 8-11.
- (1906). Notes sur les Cestodes d'oiseaux de l'Oural, I et II. *Ctrbl. Bakteriöl.*, Vol. XLII, (a) pp. 433-436, 532-537; (b) 713-730.
- (1907). Notes sur les Cestodes d'oiseaux de l'Oural. III. Quelques observations sur *Dioctocostus aspera* Fühmann et sur les organes génitaux de *Schistotaenia macrorhyncha* Rud. *Ctrbl. Bakteriöl.*, Vol. XLIII, pp. 703-708, 2 pl.
- COHN, L. (1899). Zur Systematik der Vogeltaenien. *Ctrbl. Bakteriöl.*, Vol. XXV, pp. 415-422.
- (1899). Zur Systematik der Vogeltaenien, II. *Ctrbl. Bakteriöl.*, Vol. XXVI, pp. 222-227.
- (1899). Zur Systematik der Vogeltaenien, III. *Zool. Anz.*, Vol. XXII, pp. 405-408.
- (1900). Zur Systematik der Vogeltaenien, IV. *Ctrbl. Bakteriöl.*, Vol. XXVII, pp. 325-328.
- (1900). Zur Kenntnis einiger Vogeltaenien. *Zool. Anz.*, Vol. XXIII, pp. 91-98.
- (1901). Zur Anatomie und Systematik der Vogelcestoden. *Nova Acta Leop. Carol. Akad.*, Vol. LXXIX, p. 171, 8 tab.
- COOPER, A. R. (1918). North American Pseudophyllidean Cestodes from Fishes. *Ill. Biol. Men.*, Vol. IV, No. 4.
- CREPLIN, F. C. H. (1839). Eingeweidewürmer, Binnenwürmer, Thierwürmer. *Allg. Encycl. Wiss. Künste* (Ersch, u. Gruber), Sect. 1, 32, pp. 277-302. Leipzig.
- DIAMARE, V. (1900). *Paronia carinai* n.g. sp. von Taenioden mit doppelten Geschlechtsorganen. *Ctrbl. Bakteriöl.*, Vol. XXVIII, pp. 846-850. 4 fig.
- FÜHRMANN, O. (1896). Beitrag zur Kenntnis der Vogeltaenien, II. *Rev. Suisse Zool.*, Vol. IV, pp. 111-132.
- (1900). Zur Kenntnis der Acoelinae. *Ctrbl. Bakteriöl.*, Vol. XXVIII, p. 363. 12 fig.
- (1901). Neue Arten und Genera der Vogeltaenien. *Zool. Anz.*, Vol. XXIV, p. 271. Druckfehlerberichtigung, p. 320.
- (1902). Sur deux nouveaux genres de cestodes d'oiseaux. *Zool. Anz.*, Vol. XXV, p. 357, 2 fig.
- (1905). Das Genus *Diplopostbe*, Jacobi. *Ctrbl. Bakteriöl.*, Vol. XL, pp. 217-224.
- (1906). Die Hymenolepisarten der Vögel, I. *Ctrbl. Bakteriöl.*, Vol. XLII, pp. 352-358, 442-452. 39 fig.
- (1906). Die Hymenolepisarten der Vögel, II. *Ctrbl. Bakteriöl.*, Vol. XLII, pp. 620-621, 730-755.
- (1907). Bekannte und neue Arten und Genera von Vogeltaenien. *Ctrbl. Bakteriöl.*, Vol. XLV, pp. 516-536. 43 fig.
- (1907). Die Systematik der Ordnung der Cyclophyllidea. *Zool. Anz.*, Vol. XXXII, pp. 289-297.
- (1908). Nouveaux Taenias d'oiseaux. *Rev. Suisse Zool.*, Vol. XVI, pp. 27-73. 60 fig.
- (1908). Neue Davaineiden. *Ctrbl. Bakteriöl.*, Vol. XLVII.
- (1909). Die Cestoden der Vögel des Wissen Nils. *Results of the Swedish Zoological Expedition to Egypt and the White Nile, 1901.*
- (1909). Neue Davaineiden. *Ctrbl. J. Bakt.*, Vol. XLIX, Part 1.
- (1913). Nordische Vogelcestoden aus dem Museum von Göteborg. *Meddelanden från Göteborg, Musei Zoologica Afdelning.*
- (1914). Ein neuer getrenntgeschlechtiger cestode. *Zool. Anz.*, Vol. XLIV, No. 13.
- (1919). Notes Helminthologiques suisses. *Rev. Suisse de Zool.*, Vol. XXVII, No. 11.
- V. JANICKI, C. (1906). Die Cestoden Neu-Guinea's. *Rés. Expéd. Sc. Néerlandaise Nouvelle Guinée*, Vol. V.
- JOHNSTON, T. H. (1911). New Species of Avian Cestodes. *Proc. Linn. Soc., New South Wales*. Vol. XXXVI.

- KRABBE, H. (1866). Bidrag til Kundskab om Fuglenes Baendelorme. *Dansk. Vidensk. Selsk. Skr., naturvid. matb. Afd. (5)*, Vol. VIII, pp. 249-363, 10 plates.
- (1882). Nye Bidrag til Kundskab om Fuglenes Baendelorme. *Dansk. Vidensk. Selsk. Skr., naturvid. matb. Afd. (6)*, Vol. I, pp. 349-366, 2 plates.
- KREFFT, C. (1873). On Australian Entozoa. *Trans. Entomol. Soc., New South Wales*. Vol. II, pp. 206-232. 3 pl.
- KOTLÁN, A. (1920-21). Vögel-cestoden aus New Guinea. I. Papagei-cestoden. *Annals musei nationalis Hungarici*, Vol. XVIII.
- LINNAEUS, C. (1758). *Systema naturae*. 10th Ed. Holmiae.
- LINSTOW, O. VON (1901). Die systematische Stellung von *Ligula intestinalis*, Goeze. *Zool. Anz.*, Vol. XXIV, pp. 627-634.
- LÖNNBERG, E. (1889). Bidrag till kännedomen om i Sverige förekommande Cestoder. *Bib. Svensk. Vet. Akad. Hanflingar*, Vol. XIV, Afd. 4, 69 p. 2 pl.
- LÜHE, M. (1898). Die Gliederung von *Ligula*. *Ctrbl. für Bakt.* Abt. 1, Part 23.
- (1910). Die Süßwasserfauna Deutschlands. Heft 18. Cestodes.
- MAROTEL, G. (1899). Sur deux Cestodes parasites des oiseaux (note préliminaire). *C.R. Soc. Biol., Paris*. Vol. I, pp. 935-937.
- MAPLESTONE, P. A., and SOUTHWELL, T. (1922). Australian Cestodes, V. *Ann. Trop. Med. and Parasitol.*, Vol. XVI, No. 2.
- MEGGITT, F. J. (1916). A Contribution to our Knowledge of the Tapeworms of Fowls and Sparrows. *Parasitology*, Vol. VIII.
- (1920). A Contribution to our Knowledge of the Tapeworms of Poultry. *Parasitology*, Vol. XII, No. 3.
- (1921). On two new Tapeworms from the Ostrich, with a key to the species of *Davainea*. *Parasitology*, Vol. XIII.
- MÜLLER, O. F. (1776). Zoologicae Danicae prodromus, seu animalium Danicae et Norvegiae indigenarum characteres, nominae, et synonyma imprimis popularium. 309 pp. Havniae.
- NESLOBINSKY, N. (1911). Zur Kenntnis der Vogeltäninen Mittelrusslands. *Centralbl. f. Bakt.*, Abt. 1, Vol. LVII, Part 5.
- PARONA, C. (1898). Elminti raccolti dal Dott. E. Modigliani, alle Isole Mentawai, Engano e Sumatra. *Ann. Mus. Civ. Stor. Nat. Genova*, Vol. XIX, pp. 102-124.
- RAILLIET, A., et LUCET, A. (1892). Sur le *Davainea proglottina*. *Bull. Soc. Zool. France*. Vol. XVII, pp. 105-106.
- RANSOM, B. H. (1902). On *Hymenolepis carioca* (Mag.) and *H. megalops* (Nitzsch), with remarks on the classification of the group. *Studies Zool. Lab. Lincoln, Nebr.* No. 47, pp. 151-172, tab. 23-25.
- (1905). The Tapeworms of American Chickens and Turkeys. 21st *Ann. Rep. Bureau Anim. Industry* (1904), pp. 268-285, 32 fig.
- SHIPLEY, A. E. (1909). The Tapeworms (*Cestoda*) of the Red Grouse (*Lagopus scotecies*). *Proc. Zool. Soc.* London.
- SOUTHWELL, T. (1913). Notes from the Bengal Fisheries Lab. Indian Mus., No. 1. Fish Parasites. *Rec. Ind. Mus.* Calcutta.
- STILES, C. W., and HASSALL, A. (1894). A preliminary catalogue of the Parasites contained in the Collection of U.S. Bureau of Animal Industry, U.S. Army Medical Museum, Biol. Dept. of the University of Pennsylvania (Coll. Leidy), and in Coll. Stiles and Coll. Hassall. *Veterin. Mag.*, pp. 245-354.
- STILES, C. W. (1896). Report upon the Present Knowledge of the Tapeworms of Poultry. *Bureau of Animal Industry*, Bull. 12, U.S. Dept. of Agric., Washington. pp. 1-79, tab. 1-21.
- STOSSICH, M. (1890). Elminti della Croazia. *Soc. Hist. nat. Croatica Ann.* 5, Agram, pp. 129-136, 2 tav.
- SWEET, G. (1910). Some new and unrecorded Endoparasites from Australian Chickens. *Proc. R. Soc., Victoria*. Vol. XXIII.